Exemption No. 6432

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056

In the matter of the petition of

Cessna Aircraft Company

for an exemption from § 25.562 of the Federal Aviation Regulations

Regulatory Docket No. 28370

PARTIAL GRANT OF EXEMPTION

By letter L178-61-95-1820, dated October 16, 1995, Mr. Rex Hamilton, Executive Engineer, Cessna Aircraft Company, One Cessna Boulevard, P.O. Box 7704, Wichita, KS 67277-7704, petitioned for an exemption from the emergency landing dynamic conditions of § 25.562 for multiple-occupancy, side-facing divans in the Cessna Model 750 airplane.

Sections of the FAR affected:

Section 25.562(a), as amended by Amendment 25-64, requires, in pertinent part, that seats and restraints must be designed to protect occupants from the dynamic conditions described in this section.

Section 25.562(b), as amended by Amendment 25-64, describes the dynamic tests that are required to be successfully accomplished for all seats intended to be occupied for takeoff and landing.

Section 25.562(c), as amended by Amendment 25-64, contains, in paragraphs (c)(1) through (c)(6), occupant protection pass/fail criteria associated with the dynamic testing of seats required by § 25.562(b). Paragraphs (c)(7) and (c)(8) contain the seat strength pass/fail criteria associated with those same tests.

The petitioner's supportive information is as follows:

"The Cessna Model 750 is a twin jet engine, swept wing, executive transport, with a design maximum takeoff weight of 34,500 pounds, and V_{MO}/M_{MO} of 350 knots/Mach .92. It is powered by Allison AE 3007C turbofan engines with a maximum sea level takeoff thrust rating of 6400 pounds. The certification basis for the Model 750 is Part 25 of the Federal Aviation Regulations effective February 1, 1965, as amended by 25-1 through 25-74, plus 25.1316 as amended by 25-80, Part 34 of the Federal Aviation Regulations effective September 10, 1990, plus any amendments in effect on the date of type certification, Part 36 of the Federal Aviation Regulations effective December 1, 1969, as amended by Amendment 36-1 through the amendment in effect on the date of type certification plus the Noise Control Act of 1972. In addition, certification to the Joint Requirements of the Joint Aviation Authorities (JAA) in accordance with the provisions of JAR-25 including Amendments 90/1, 91/1, and 93/1 has been requested.

"14CFR 25.562 provides standards for occupant protection and structural strength during an emergency landing condition.

"Section 25.562(a) requires the seats and the restraints to protect the occupant when exposed to the impact conditions described in this paragraph.

"Section 25.562(b) describes the required impact conditions.

"Section 25.562(c) describes occupant pass/fail criteria associated with the impact conditions described in 25.562(b).

"Cessna's reasons for seeking exemptive relief from the requirements of §25.562 for side facing multiple seating arrangements are summarized as follows.

> "Considering the experience from the development of a single place side facing seat, the development cost for a three-place multiple occupancy side facing sofa has been calculated to be approximately $1.5 million. It is our feeling that this is a prohibitive expenditure.

"Lack of certification requirements for multiple occupancy side facing seating:

> "The floor deformation criteria defined in §25.562(b) must be reviewed to define a suitable criteria for floor fittings and structural deformation.
>
> "There is no criteria defining the pass/fail criteria for incidental contact between adjacent occupants."

"Twisting of the ATD at impact may cause the shoulder harness to press against the occupant's neck or soft tissue in the lower abdomen. A pass/fail criteria for the post test position, and loads, of the occupant restraint is not defined.

"Cessna is currently experiencing a 95 - 98 percent penetration of multiple occupancy side facing seating. In order to create an executive atmosphere with a higher utilization rate, and to easier facilitate meetings during flight, some form of multiple occupancy side facing seating is being requested by most of our Model 750 customers. Without the ability to install multiple occupancy side facing seating in the Model 750, Cessna will be put at a competitive disadvantage. Customers will be lost to competitors offering derivative airplanes that have the possibility of using multiple occupancy side facing seating. These airplanes will not have undergone the rigorous testing and certification criteria as applied to the Model 750.

"Public Interest:

"Any multiple occupancy side facing seating in the model 750 will meet the static strength requirements of §25.561 and the occupant protection requirements of §25.785 prior to amendment 25-64, and will provide a level of safety equal to what is provided in the Cessna Model 650.

"Reason why the exemption would not adversely affect safety:

"From the Cessna Model 650 accident statistics, it is our conclusion that divans or multiple-place side facing seating configurations certified to the dynamic criteria installed in the aircraft would have been of no value in the minimization of injury to the occupants. As of April 1995 the Model 650 fleet had accumulated a total of 766,000 flight hours with 84,800 total landings. Of the 290 units manufactured, only two units have been lost in flight accidents. Both of these accidents were the result of flight into mountainous terrain and were deemed non-survivable."

A summary of Cessna Aircraft's petition was published in the Federal Register on December 5, 1995 (60 FR 62287). No comments were received.

The FAA's analysis/summary is as follows:

Amendment 25-64 of part 25 of the Federal Aviation Regulations (FAR) revised the emergency landing conditions that must be considered in the design of airplanes by revising the static loads, §25.561, for the entire airplane, and by introducing dynamic loads, § 25.562, for seating intended to be occupied for takeoff and landing. The intent of Amendment 25-64 is to provide equivalent protection for seated occupants,

irrespective of whether the seats are forward-, side-, or aft-facing. However, since the preponderance of airplane seating is forward-facing, existing pass/fail criteria have focused primarily on these seats. Since the June 16, 1988, effective date of Amendment 25-64, several airplanes with forward- or aft-facing seats in their interior configurations have already been type certificated using the existing regulatory criteria, and the petitioner has certificated one airplane with a single-place, side-facing seat using equivalent criteria defined in an Issue Paper. The Cessna 750 is the petitioner's first airplane with both multiple-place, side-facing seats (divans) in its interior configurations and Amendment 25-64 in its certification basis. Nonetheless, this is not the first instance in which it has been necessary to consider side-facing divans with respect to the requirements of Amendment 25-64. An earlier certification project for another manufacturer resulted in a temporary exemption to allow development of appropriate criteria.

Accordingly, appropriate pass/fail criteria need to be developed that fully address the concerns specific to occupants of side-facing divans. This issue has been discussed extensively at industry forums on dynamic testing, as well as by the Aviation Rulemaking Advisory Committee working group on dynamic testing. The FAA has advised that such criteria must, as a minimum, address certain areas of concern that are noted below:

1. **Contact between adjacent occupants**. One occupant must not be used to provide energy absorption for another occupant. If the seat or restraint design does not obviate contact, the consequences of head, torso, and upper and lower limb contact must be shown to be acceptable. "Incidental contact" mentioned by the petitioner would have to be defined, but such contact as normally occurs between occupants of multiple-place, forward-facing seats has been found to be acceptable.

2. **Retention of the occupant in the seat and restraint system**. This concern must address the lower limbs as well as the torso. Failure to restrain the lower limbs may result in undesirable repositioning of the restraint system (e.g., the lap belt riding up to the soft stomach area, a shoulder harness pressing against the neck, or undesirable twisting of the lower lumbar spinal column). A quantitative means of assessing lower limb movement (leg flail) and a corresponding pass/fail criterion should be proposed.

3. **Limiting the load on the torso in the lateral direction**. The human torso has relatively low tolerance to loads in the lateral direction. This is not a significant concern on forward- or aft-facing seats, but it is on side-facing seats. A means of addressing this concern is the "Thoracic Trauma Index," (TTI) which is defined in Title 49, Part 572, Subpart F, of the Code of

Federal Regulations (CFR). Tests to develop a TTI involve the use of a different anthropomorphic test dummy (ATD) than described in § 25.562. The ATD described in Title 49, CFR Part 572, Subpart F - Side Impact Dummy (SID) 50th Percentile Male, is appropriate. The FAA would accept a TTI of 85, which is a value acceptable to the National Highway Traffic Safety Administration (NHTSA). The FAA notes that the petitioner did incorporate this criteria into the previously mentioned single-place, side-facing seat.

4. **Reducing the likelihood of pelvic fracture**. The NHTSA has adopted a limit of 130 g's for acceptable pelvic acceleration as determined in tests using the SID ATD noted in item 3.

NOTE: The use of the SID ATD would be limited only to tests involving items noted in 3 and 4 above. The standard Hybrid II ATD should be used in any other dynamic testing (e.g., head injury criteria, seat structural strength, evaluation of restraint integrity, femur loads, and compressive load measured between the pelvis and the lumbar column).

5. **Appropriate simulation of seat and restraint installation during the tests**. In many installations, it is anticipated that the upper torso loads of the side-facing occupant will be reacted by wall structure adjacent to the occupant. The wall structure must be considered as part of the seat or restraint system, and therefore included in an appropriate manner as part of the test configuration. As a minimum, the test must demonstrate that the wall will restrain the forward motion of the occupant.

6. **Consideration of all possible seating combinations**. All of the above must be shown to be acceptable for all possible combinations of seating which are allowed (e.g., a single occupant of the divan in any seat position, or, assuming a three-place divan, two occupants in any of the three possible seating combinations).

The FAA notes that the petitioner has requested a permanent exemption from § 25.562 in its entirety. The basis for this request is twofold. First, the cost of compliance is expected to be high, and second, the certification criteria are not sufficiently developed. As noted above, the FAA acknowledges that most of the existing certification criteria are directed at forward- and aft-facing seats. The *applicability* of the general requirement to protect occupants contains no such bias however, and the lack of available criteria is not grounds for excusing consideration of a regulation. In addition, much of the criteria *are* applicable to side-facing divans and could be addressed within a typical seat development program. In particular, the structural requirements are equally valid for these type of seats, and lumbar injury

criteria are similarly directly applicable. The FAA can see no justification in an exemption from these criteria, even on a temporary basis.

Regarding the potential cost of certification, no breakdown of the estimate is given, and the problem of developing appropriate criteria for multiple occupancy, side-facing divans is an industry problem which should engender cooperation among manufacturers to reduce costs. In addition, the FAA is on record as agreeing to assist in such development at the Civil Aeromedical Institute, which can further reduce costs. The desire to continue to install multiple-occupancy divans dictates that the primary responsibility for proposing means of compliance lies with industry.

With regard to the petitioner's comments concerning competition with existing airplanes certificated prior to Amendment 25-64, the FAA observes that the introduction of any new factor, including new safety requirements, into the marketplace can always be expected to be temporarily disturbing to the status quo. It is unacceptable to seriously consider foregoing the introduction of new safety requirements because it may disturb the existing competitive balance. However, the FAA is not insensitive to this concern and, as demonstrated by this partial grant, is willing to allow a degree of phase-in for complying with especially difficult criteria. In any event, rather than viewing the imposition of this particular safety improvement as detrimental to its competitive position, as the petitioner apparently does, one could argue that manufacturers who offer airplanes featuring enhanced safety for its executive customers may likely enjoy a competitive advantage. Finally, the petitioner is advised that the FAA, in its effort to promote improved safety throughout the fleet, has taken the position of very strongly encouraging the incorporation of dynamically qualified seats into the scope of any significant modification to existing pre-Amendment 25-64 airplanes, including those manufactured by the petitioner's competitors.

Regarding the accident data cited by the petitioner, the FAA cannot accept a lack of accident experience as justification for non-compliance. The purpose of such crashworthiness requirements is to help mitigate the effects of accidents when they do occur. The absence of existing accident data does not ensure that accidents will not occur in the future. Thus, the regulations establish the minimum levels of safety, assuming that certain conditions will exist. The public interest statement by the petitioner does not address how granting the exemption would be in the public interest, but rather that the level of safety would not be worsened over previous models. This fails to recognize that the minimum level of safety has been increased with the adoption of amendment 25-64

The conditions associated with the following partial grant reflect the above considerations and discussions, and are established to allow a controlled and time-limited use of non-compliant side-facing divans and restraints while an expedited schedule of research and testing is accomplished. Although this temporary exemption

is granted at this time, there is an expectation that it may be extremely difficult or impractical to develop acceptable and commercially desirable designs that can provide the same level of safety for occupants of side-facing divans as for other seating. Accordingly, in order to preclude a protracted period of time during which fruitless research is being deliberately accomplished while occupants of side-facing divans are not afforded equivalent safety, the FAA does not anticipate being predisposed to extend this grant unless success is imminent. The petitioner should expect the probability of needing to remove any side-facing divans from service while the necessary research is completed.

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest and will not significantly affect the level of safety provided by the regulations. Therefore, pursuant to the authority contained in 49 USC 40113 and 44701, delegated to me by the Administrator (14 CFR 11.53), Cessna Aircraft is hereby granted the following to the extent necessary to permit type certification of the model 750 airplane equipped with side-facing divans:

1. Within six months from the issue date of this partial grant, the petitioner shall submit to the Wichita Aircraft Certification Office, for FAA approval, a side-facing divan developmental test proposal for addressing, as a minimum, the specific concerns identified in the noted Issue Paper and repeated herein.

2. Upon successful completion of certification testing, the petitioner shall provide this office with a schedule for assuring that the affected Cessna 750 fleet will be retrofitted by November 30, 1996.

NOTE: This partial grant of exemption expires November 30, 1996. Accordingly, the airworthiness certificates issued for any U.S.-registered airplanes equipped with side-facing divans that have not been shown to comply with the conditions of this grant by that date will also expire on that date.

Issued in Renton, Washington, on April 25, 1996.

/s/ Ronald T. Wojnar
Manager, Transport Airplane Directorate
Aircraft Certification Service, ANM-100